SIMPLIFIED AUTOMATIC TYRE DEMOUNTING DEVICE, AND TYRE REMOVAL MACHINES EQUIPPED THEREWITH

This invention relates generally to those means, installed on tyre removal machines, which enable the tyre to be demounted from the wheel rim.

Devices are known which, associated with rotary means for supporting the wheel rim, enable the tyre to be extracted from the wheel rim without the active intervention of the operator during the operation. One of these devices is fully described in patent application RE2000A000078 filed in the name of the same applicant, to the text of which reference should be made for a fuller understanding of the known art.

Briefly the device described on said patent application comprises an operative head provided at least with a demounting tool, which can rotate about the main axis of said operative head, and arranged to interact with the edge of the tyre to grip the tyre bead and extract it from the bead retention seat in the edge of the wheel rim, to enable the tyre to be extracted from the wheel rim.

Although the device perfectly performs the operations for which it is intended, it has proved costly because of complicated construction.

The object of this invention is therefore to overcome the drawbacks of the known art within the context of a rational and reliable solution which is of simple and economical construction.

The invention attains said object by an automatic device for demounting

the tyre from the wheel rim which, associated with rotary means for supporting the wheel rim, is able to extract the tyre from the wheel rim without requiring any intervention by the operator.

Said device comprises a demounting tool which is associated with means enabling it to be positioned in a tyre bead seeking and gripping position in which the tool is perpendicular to the axis or orientated towards the centre of the wheel rim, and in a position for extracting said tyre bead from the wheel rim, in which the tool is perpendicular to the axis or orientated in the opposite direction. Specifically, said positioning means comprise a bar, to the end of which said tool is hinged in an intermediate position, and a connecting rod which at one end is hinged to one end of said tool, and at the opposite end is connected to said bar by a lever, said bar being connected to means for advancing it and withdrawing it.

In a first embodiment of the invention, said connecting rod is of variable length and comprises a cylinder-piston unit, such that when the tool is positioned in the tyre bead seeking and gripping position, it is orientated towards the centre of the wheel rim.

In a simplified version of the invention, said connecting rod is of fixed length, such that when the tool is in said tyre bead seeking and gripping position, it is perpendicular to the axis of said bar.

According to the invention the rotary means for supporting the wheel rim can translate horizontally to approach and withdraw from the device of the invention on the basis of the wheel rim diameter and possibly of the

operative position assumed by the demounting tool.

Finally, combining the device of the invention with said rotary means for supporting the wheel rim results in an assembly representing a complete tyre removal machine, which could be provided with a bead release device.

The special characteristics of the invention are defined in the claims.

The constructional and operational characteristics of the invention will be apparent from the ensuing description of a preferred embodiment thereof given by way of non-limiting example and illustrated in the accompanying drawings.

Figure 1 is a perspective view of the tyre removal machine on which the invention is installed.

Figure 2 is a second perspective view of the tyre removal machine on which the invention is installed.

Figure 3 is a partly sectional view of the device of the invention in a first operative position.

Figure 4 is a partly sectional view of the device of the invention in a second operative position.

Figures from 5 to 10 are schematic views of the invention during the demounting of the tyre from the wheel rim.

Figure 11 is a partly sectional view of a variant of the invention in a first operative position.

Said figures show the tyre removal machine 1 comprising a lower casing 2, from which there upperly emerges a rotary shaft 3 for supporting the support and locking means 4 for the wheel rim 5 on which the tyre 6 is

installed.

The shaft 3, and hence the support and locking means 4 for the wheel rim 5, can translate axially, being operated by suitable operating means positioned within the casing 2.

Said support and locking means 4 and said operating means for the shaft 3 are not described in detail as they are known.

To the rear of the casing 2 there is present a vertical frame 7 provided with slide guides 70 for a carriage 8 arranged to support the device 9 of the invention.

The carriage 8 can translate vertically by virtue of a known male-female screw mechanism 300, being provided with wheels 81 travelling along guides 70 on the frame 7.

The device 9 comprises a tool 15 for automatically demounting the tyre 6 from the wheel rim 5. The device 9 comprises means 100 for positioning the tool 15 in a first tyre bead seeking and gripping position in which the tool 15 is orientated towards the centre of the wheel rim, and means 200 enabling the tool 15 to be positioned in a second position for extracting said tyre bead from the wheel rim 5, in which the tool 15 is perpendicular to the axis of the device 9 or is orientated towards the frame 7.

Said tool operating means 200 comprise a first cylinder-piston unit 10 composed of a cylinder 11 within which there slides a piston 12, the piston rod 13 of which emerges from the interior of the cylinder and is fixed to a bar 14 which slides within a prolongation 110 of the cylinder.

The tyre demounting tool 15 is hinged to the free end of the bar 14. Said tool 15 is substantially of hook shape and upperly presents two lugs 150 between which said tool operating means 100 are connected.

Said operating means 100 comprise a second cylinder-piston unit 16 composed of a cylinder 17 externally hinged to said lugs and containing a sliding piston 18, the piston rod 19 of which emerges from the cylinder 17. The free end of the piston rod 19 is fixed to the end of a profiled plate 20 which slides on the upper surface of the prolongation 110 of the cylinder 11. To the opposite end of the plate 20 there are hinged a pair of levers or arms 21 positioned at the sides of the prolongation 110 of the cylinder 11 and hinged at their opposite end via a slot 210 to an appendix 22, which branches from the prolongation 110 of the cylinder 11.

Again with reference to Figure 1, each of the levers 21 is pivoted at its centre to a pin 11 on the bar 14, which emerges from a respective slot 112 on the prolongation 110.

The two levers or arms 21 enable the tool 15 to be positioned in said second extraction position shown in Figure 10.

The operation of the invention can be controlled by the operator via suitable control means, not shown, positioned on the casing 2 of the tyre removal machine, or can be controlled automatically by a processor.

After releasing the tyre bead and locking the wheel in position, the operator adjusts the position of the shaft 3 relative to the frame 7 on the basis of the wheel diameter. At this point the operator operates the device 9 to move it into the position shown in Figure 5, i.e. he positions the demounting tool 15 in proximity to the wheel rim edge, at a few millimetres therefrom.

When in this position the device 9 is lowered by a predetermined amount as shown in Figure 6, and its hook-shaped lower end is inserted between the bead retaining flange on the wheel rim and the sidewall of the tyre.

When in position, the tool is brought into the bead seeking and gripping position (Figure 7) by rotating it about the vertical axis through a predetermined angle in the direction of the wheel rim axis, so that the hook-shaped end of the tool 15 grips the edge of the tyre bead.

With reference to Figure 8 the tool is then brought into the first extraction position coinciding with the (vertical) rest position. From this position the device 9 is raised, as shown in Figure 9, in order to extract a portion of the upper tyre bead to above the wheel rim.

At the same time the wheel rim is rotated so that the entire upper tyre bead leaves the wheel rim.

It should be noted that during the entire tyre demounting operation the tool 15 never touches the wheel rim edge, hence there is no risk of damaging this edge.

When the upper tyre bead has been extracted, the tool is positioned in the seeking position to release the tool from it, after which the tool is returned to its rest position.

To facilitate the escape of the tyre bead from the wheel rim and reduce the stresses to which the bead is subjected, the tool 15 can be positioned in said second extraction position (Figure 10) by the action of the cylinder-piston unit 10, as soon as the tyre upper bead has been gripped in the described manner and a part thereof extracted from the wheel rim edge.

Operating the cylinder-piston unit 10 causes the bar 14 to translate axially, and with it the profiled plate 20 which, because of the mechanism by which it is secured to the bar 14, advances by a greater amount than the bar to cause the tool to rotate into said second extraction position.

When the tool is in position the wheel rim is rotated so that the entire

upper bead escapes from the wheel rim.

Figure 11 shows a simplified variant of the invention, which is suitable for use, for example, in demounting large diameter tyres.

In the description of this variant the same reference numerals are used to indicate components identical to those already described.

The automatic tyre demounting device 24 of this simplified variant differs from the preceding in that the position for seeking and gripping the tyre bead requires the tool to be maintained perpendicular to the axis, rather than orientated towards the centre of the wheel rim as in the preceding embodiment.

Consequently, as can be seen from Figure 11, the tool 15 is connected to the lever 21 by a connecting rod 25.

The operation of this variant of the invention is similar to that described, but with the difference that the tyre bead is sought and gripped while maintaining the tool perpendicular to the device axis.